

REMARKS

Claims 18-26, 29-31, 34 and 37-41 are pending in the application. Claims 26, 31, 34 and 39-41 have been indicated as allowable. Claims 18-24, 25, 29, 30, 37 and 38 are presented for reconsideration. Claims 18, 29 and 30 are the only independent claims under consideration.

Claims 18, 22, 24, 29, 30 and 38 have been rejected under 35 U.S.C. § 102 as being anticipated by U.S. Patent No. 6,392,742 to Tsuji. This rejection is respectfully traversed.

Pending independent Claim 18 is directed to an illumination optical system that illuminates a surface to be illuminated using light from a light source. In the illumination optical system, a diffractive optical element forms a desired light intensity distribution upon a predetermined plane. An angular distribution transforming unit transforms angular distribution of light incident or to be incident on the diffractive optical element into plural predetermined distributions. A multiple beam producing unit has the predetermined plane as its light entrance surface. A light projecting element superposes light rays from the multiple beam producing unit upon one another on the surface to be illuminated.

Pending independent Claim 29 is directed to exposure apparatus in which an illumination optical system illuminates a mask with use of light from a light source. In the illumination optical system, a diffractive optical element forms a desired light intensity distribution upon a predetermined plane. An angular distribution transforming unit transforms angular distribution of light incident or to be incident on the diffractive optical element into plural predetermined distributions. A multiple beam producing unit has the predetermined plane

as its light entrance surface. A light projecting element superposes light rays from the multiple beam producing unit upon one another on the surface to be illuminated. A projection optical system projects a pattern of the mask illuminated with light from the illumination optical system onto a wafer.

Pending independent Claim 30 is directed to a device manufacturing method in which a photosensitive material is applied to a wafer and a mask surface to be illuminated is illuminated by use of light from an illumination optical system. In the illumination optical system, a diffractive optical element forms a desired light intensity distribution upon a predetermined plane. An angular distribution transforming unit transforms angular distribution of light incident or to be incident on the diffractive optical element into plural predetermined distributions. A multiple beam producing unit has the predetermined plane as its light entrance surface. A light projecting element superposes light rays from the multiple beam producing unit upon one another on the surface to be illuminated. A projection optical system transfers a pattern of the mask onto a wafer and the transferred pattern is developed.

In Applicant's view, Tsuji discloses an illumination system that has a light source. An emission angle preserving optical element emits light from the light source at a certain emission angle. A collecting optical system collects the light from the emission angle preserving optical element. A pattern forming optical system having at least a diffractive optical element produces, on a predetermined plane, a light pattern of a desired shape having a uniform light intensity distribution by use of light from the light collecting optical system. A multiple-beam producing system produces plural light beams. A zooming optical system projects the light

intensity distribution on the predetermined plane onto a light entrance surface of the multiple-beam producing system at a predetermined magnification and an illuminating device superposedly projects lights from a light exit surface of the multiple-beam producing system upon a surface to be illuminated.

According to the invention defined in pending Claims 18, 29 and 30, an angular distribution transforming unit transforms the angular distribution of light incident or to be incident on a diffractive optical element that forms the desired light intensity distribution upon a predetermined plane into plural predetermined distributions. Advantageously, the transformation of angular distribution of light incident on the diffractive optical element into plural predetermined distributions assures a plurality of deformed illumination modes on the basis of the least number of diffractive optical elements.

Tsuji may disclose an illumination optical system that has interchangeable emission angle preserving optical elements 12a and 12b (Figs. 5A and 5B). In Tsuji, however, the light exit surface of the emission angle preserving optical element 12a or 12b is disposed in a Fourier transform relationship with the diffractive optical element 4. As a result, when the emission angle preserving optical elements 12a and 12b are interchanged, the illumination region upon the diffractive optical element 4 is changed but the angular distribution of light illuminating the diffractive optical element 4 is unchanged. Accordingly, it is not seen that Tsuji in which angular distribution of light remains unchanged upon interchange of emission angle preserving optical elements in any manner teaches or suggests the feature of Claims 18, 29 and 30 of an angular distribution transformation unit that transforms the angular distribution of light incident

on the diffractive optical element that forms a desired light intensity upon a predetermined plane. It is therefore believed that pending Claims 18, 29 and 30 are completely distinguished from Tsuji and are allowable thereover.

Claims 18, 22, 24, 25, 29, 30 and 38 have been rejected under 35 U.S.C. § 103 as being unpatentable over Japanese patent document number 11-176721 (Tsuji '721) in view of either U.S. Patent No. 5,659,529 to Kudo or Japanese patent document number 11-054426 (Mizouchi). This rejection is respectfully traversed.

Applicant notes that Japanese patent document No. 11-176721 corresponds to the previously discussed U.S. Patent 6,392,742 (Tsuji).

In Applicant's opinion, Kudo discloses an illuminating optical apparatus for performing (e.g., oblique illumination) has an arrangement in which an image of a reflecting mirror for reflecting a light beam from a light source is formed while being curved. With this arrangement, an annular secondary source with a light intensity distribution having moderate tails can be obtained.

Mizouchi, in Applicant's view, discloses a lighting device and aligner that allows an irradiated surface to be lit evenly with high lighting efficiency by providing an optical flux adjuster near an outgoing surface of an optical flux mixing means that allows adjustment of light quantity distribution on an incident surface of plural optical flux generators.

As aforementioned, Japanese patent document No. 11-176721 (Tsuji '721) only discloses an illumination optical system that has interchangeable emission angle preserving optical elements 12a and 12b (Figs. 5A and 5B) in which the light exit surface of the emission

angle preserving optical element 12a or 12b is disposed in a Fourier transform relationship with the diffractive optical element 4.

In contrast to the feature of Claims 18, 29 and 30 of transforming the angular distribution of light incident on a diffractive optical element, the illumination region upon the diffractive optical element 4 of Tsuji '721 is changed but the angular distribution of light illuminating the diffractive optical element 4 is unchanged when the emission angle preserving optical elements 12a and 12b are interchanged.

Kudo may teach a lens changing unit 12 and Mizouchi may teach a lens changing unit 11 for use in exchanging lenses. Neither Kudo nor Mizouchi, however, in any manner teaches or suggests the feature of Claims 18, 29 and 30 relating to transforming an angular distribution of light incident on a diffractive optical element. Accordingly, it is not seen that the addition of Kudo's or Mizouchi's teaching of exchanging lenses devoid of any suggestion of transforming angular distribution of light added to Tsuji '721's change of the illumination region upon a diffractive optical element that does not change the angular distribution of light illuminating the diffractive optical element could possibly suggest the feature of Claims 18, 29 and 30 of an angular distribution transforming unit that transforms the angular distribution of light incident or to be incident on a diffractive optical element for forming a desired light intensity distribution upon a predetermined plane into plural predetermined distributions. It is therefore believed that pending Claims 18, 29 and 30 are completely distinguished from any combination of Tsuji '721, Kudo and 7 and are allowable.

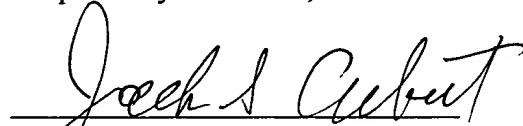
For the reasons noted above, Applicant submits that the present invention, as recited in independent claims 18, 29 and 30, is patentably defined over the cited art.

Dependent claims 19-25, 37 and 38 also should be deemed allowable, in their own right, for defining other patentable features of the present invention in addition to those recited in their respective independent claims. Further individual consideration of these dependent claims is requested.

Applicant further submits that the instant application is in condition for allowance. Favorable reconsideration, withdrawal of the rejection set forth in the above-noted Office Action and an early Notice of Allowance are requested.

Applicant's attorney, Steven E. Warner, may be reached in our Washington, D.C. office by telephone at (202) 530-1010. All correspondence should be directed to our address listed below.

Respectfully submitted,



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